WHAT IS CLAIMED IS:

1. A lens driving apparatus comprising:

a lens holder holding a lens; and

driving means for providing linear motion to the lens holder along an optical axis of the lens;

said driving means further comprising:

an electromagnetic mechanism, provided at the outer circumference of the lens holder in an enclosing manner for generating a torque around the optical axis; and

a switching mechanism for switching the torque generated by the electromagnetic mechanism to a linear driving force along the optical axis so as to linearly move the lens holder.

2. The lens driving apparatus as set forth in Claim 1 wherein multiple lens holders, each holding a lens, are arranged in the optical axial direction wherein said switching mechanism is provided to each of said multiple lens holders.

3. The lens driving apparatus as set forth in Claim 1 wherein said electromagnetic mechanism comprises:

a rotor having a ring-like magnet whose outer circumference is magnetized in a circumferential direction; and

a stator, provided with multiple magnetic poles facing the outer circumference of the ring-like magnet.

4. The lens driving apparatus as set forth in Claim 3 wherein

said lens driving apparatus further comprises supporting means for rotatably supporting said rotor around the optical axis while limiting the linear motion of said lens holder along said optical axis;

wherein said switching mechanism further comprises:

a guiding channel provided on one of said lens holder's outer circumference and said rotor's inner circumference; and

an engagement means, which is held at the other of said lens holder's outer circumference and said rotor's inner circumference, being inserted into said guiding channel to provide relative linear motion to said lens holder in the optical axial direction along said guiding channel as said rotor rotates.

5. The lens driving apparatus as set forth in Claim 4 wherein a plurality of said lens holders holding said lenses are arranged in the optical axial direction and said switching mechanism is provided for each of said lens holders.

6. The lens driving apparatus as set forth in Claim 5 wherein said switching mechanisms corresponding to different lens holders are given guiding channels of different patterns.

7. The lens driving apparatus as set forth in Claim 3 wherein said rotor is integrally formed with said lens holder; wherein said switching mechanism further comprises:

a guiding channel provided on one of said lens holder's outer circumference and said rotor's inner circumference; and

an engagement means, which is held at the other of said lens holder's outer circumference and said rotor's inner circumference, being inserted into said guiding channel to provide a relative linear motion to said lens holder in the optical axial direction along said guiding channel as said rotor rotates.

8. The lens driving apparatus as set forth in Claim 4 wherein said engagement means is spherical and is rotatably held by the surface not selected previously for said guiding channel.

9. A lens driving apparatus having a lens holder holding a lens and driving means for providing linear motion to the lens holder along the optical axis of the lens wherein said lens driving apparatus further comprises:

an electromagnetic mechanism, surrounding the outer circumference of the lens holder for generating a driving force required for letting the lens holder make linear motion along the optical axial direction; and a guiding shaft, guiding the linear motion of said lens holder along the optical axis by limiting the degree of inclination of said lens holder along the optical axis.

10. The lens driving apparatus as set forth in Claim 9 wherein said lens holder making linear motion is guided by two guiding shafts simultaneously; said engagement portion having a sliding portion for sliding said guiding shaft in the optical direction wherein one sliding portion is made longer than the other portion in said optical axial direction.

11. The lens driving apparatus as set forth in Claim 9 wherein said lens holder has an escaping portion cut out on said lens holder on the inner portion in the radial direction to accommodate said long sliding portion guiding said lens holder where said guiding shaft not guiding said lens holder is inserted therein.

12. The lens driving apparatus as set forth in Claim 9 wherein an additional lens holder is provided, arranged along with the lens holder in parallel with the optical axis; and three guiding shafts are circumferentially arranged at an even spacing wherein said two lens holders are guided by a total of two guiding shafts, namely, one common guiding shaft and another guiding shaft.

13. The lens driving apparatus as set forth in Claim 9 wherein said driving means comprises:

an electromagnetic mechanism provided at the outer circumference of the lens holder in a surrounding manner for generating a torque around the optical axis; and

a switching mechanism for switching a torque generated by the electromagnetic mechanism to a linear motion along the optical axis; wherein the switching mechanism having said guiding shafts is arranged within the space surrounded by said electromagnetic mechanism.

14. The lens driving apparatus as set forth in Claim 13 wherein said electromagnetic mechanism comprises:

a rotor, having a ring-like magnet on its outer circumference wherein said magnet is circumferentially magnetized in a S/N alternating manner; and

a stator, having multiple poles arranged circumferentially to face the outer circumference of said ring-like magnet;

wherein said switching mechanism further comprises:

a guiding channel provided on one of said lens holder's outer circumference and said rotor's inner circumference; and

an engagement means, held by the other of said lens holder's outer circumference and said rotor's inner circumference, and the other end, which is the other of said lens holder's outer circumference and rotor's inner circumference wherein said electromagnetic mechanism further comprises a projection portion for linearly moving said lens holder along the optical axis by relatively moving said guiding channel as said rotor rotates.

15. The lens driving apparatus as set forth in Claim 14 wherein said lens driving apparatus has said projection in the vicinity of said engagement portion.

16 The lens driving apparatus as set forth in Claim 15 wherein said long sliding portion is provided in such a manner that it projects in the space between two lens holders; said switching mechanism changing the distance between said lenses held by said two lens holders wherein said long sliding portion can go into said escaping portion corresponding to each of said long sliding portions when the distance between said lenses is reduced, thereby leaving space between the outer circumferences of each of said long sliding portions and the inner circumference of said escaping portion.

17. The lens driving apparatus as set forth in Claim 9 wherein said lens and said lens holder are integrally molded utilizing a resin; said lens being an aspherical resin lens; a part of said lens holder providing an engagement portion.

18. A thin camera comprising the lens driving apparatus as set forth in Claim 9 wherein said lens driving apparatus comprises:

a cover glass secured toward the object end in the lens driving apparatus;

an image capturing element, provided at the opposite end of said cover glass in the optical axial direction putting said lens in said lens driving apparatus therebetween; and

an iris, fixed onto the lens holder holding said lens while providing a linear motion thereto in the optical axial direction in the lens driving apparatus.

19. The thin camera as set forth in Claim 18 further comprising two or more lens holders, provided to vary the distance between lenses for zooming; and an iris, fixed onto the image capturing element end of the lens holder arranged toward the object end.

20. A cellular phone having a camera as set forth in Claim 18 wherein said thin camera is adopted to a camera portion thereof, and a board for connecting an image capturing element is arranged between said image capturing element and said back of the casing wherein the surface of the cover glass in said thin camera is leveled with the surface of the casing; the thickness between said cover glass surface and the back of said image capturing element in said thin camera being set to 6 – 10 mm.

21. A lens driving apparatus comprising:

a lens holder holding a lens; and

a driving mechanism that provides linear motion to the lens holder along an optical axis of the lens;

said driving mechanism including:

an electromagnetic mechanism, positioned around the outer circumference of the lens holder, for generating a torque around the optical axis; and a switching mechanism that translates the torque generated by the electromagnetic mechanism to a linear driving force along the optical axis so as to linearly move the lens holder.